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ABSTRACT

The number of college graduates majoring in science, engineering, or mathematics is widely perceived as vital to the future international competitiveness of the United States. This report examines the major fields of study of a representative sample of high school seniors from the 1980 High School and Beyond senior cohort survey who had graduated from college by 1986 and compares those who majored in engineering, mathematics, or the natural and physical sciences with those in other fields. Among the significant findings are: (1) the proportion of males was higher than the proportion of females; (2) there were no significant differences in the proportions in majors among Whites, Blacks or Hispanics; (3) students with higher grades in high school, students who reported more time spent on homework, or students who had high achievement test scores graduated more frequently with a major in science, engineering, or mathematics; (4) those who studied more mathematics in high school graduated more frequently with a major in science, engineering, or mathematics; (5) the number of students who moved out of the sciences in college was larger than the number who moved in; (6) females who had higher grades and took calculus in college were less likely than males with similar backgrounds to graduate with a major in science, engineering, or mathematics; and (7) more male college graduates stated in high school that they intended to major in science, engineering, or mathematics than female college graduates. (CW)

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NATIONAL CENTER FOR EDUCATION STATISTICS

Survey Report

June 1990

ED324197

Who Majors in Science?

College Graduates in Science, Engineering, or Mathematics from the High School Class of 1980

Henry A. Gordon
Postsecondary Education Statistics Division

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
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June 1990

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HIGHLIGHTS

This report examines the major fields of study of a representative sample of 1980 high school seniors who had graduated from college by 1986 and compares those who majored in engineering, mathematics, or the natural and physical sciences (about 23.4 percent) with those who majored in other fields. A number of relationships were significant:

- The proportion of males who graduated with majors in science, engineering, or mathematics (30.9 percent) was almost twice as high as the proportion of females (16.4 percent).

- There were no significant differences among whites, blacks, and Hispanics in the proportion who majored in science, engineering, or mathematics.

- Students who received higher grades in high school, who reported spending over 5 hours a week on homework, or who were in the top quartile of the High School and Beyond achievement test more often graduated from college with a major in science, engineering, or mathematics.

- Those who studied calculus, physics, or trigonometry in high school more often graduated from college with a major in science, engineering, or mathematics.

- While in college, some students changed their minds about the major they had intended to pursue while in high school. Overall, the number of students who moved out of science, engineering, or mathematics was somewhat larger than the number who moved into these fields between high school and college graduation.

- Although grades in high school and courses taken there were related to graduating from college with a major in science, engineering, or mathematics, females who received mostly A's in high school and who took calculus graduated less often with majors in these fields than males with similar backgrounds.

- Almost twice as many male (33.9 percent) as female college graduates (18.2 percent) stated in high school that they intended to major in science, engineering, or mathematics.

ACKNOWLEDGMENTS

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INTRODUCTION

The number of college graduates majoring in science, engineering, or mathematics is widely perceived as vital to the future international competitiveness of the Nation. Therefore, a good deal of attention has recently been focused on possible ways to increase the numbers of college students who major in these fields. For example, the American Association for the Advancement of Science has called for significant changes in the way science is taught with the aim of stimulating interest in science among all students and ultimately increasing the number of scientists.

Despite the fact that education is seen as critical, relatively little is known about students who major in these fields, a gap that this report attempts to fill. Its purpose is to describe those persons who were high school seniors in 1980 and had graduated from college by 1986 with a major field of study in the natural or physical sciences, engineering, or mathematics (including computer science) and to compare them with students in all other majors. (Students who majored in the behavioral or social sciences are not included).[1]

SOURCE OF DATA

The data in this report are from the 1986 followup of the 1980 High School and Beyond senior cohort survey. High School and Beyond, a longitudinal study of 1980 high school seniors and sophomores, began with questionnaire data from randomly selected students in a nationally representative sample of public and private high schools. Data are available for 10,536 individuals who were high school seniors in 1980 and who responded to the 1986 followup questionnaire. These data have been weighted to represent 3,025,000 1980 high school seniors. (Further information on the sample is available in the appendix.)

By 1986, approximately 18 percent of the 1980 high school seniors (approximately 514,000) had graduated from college with a bachelor's degree.[2] Data on the major field of study of the college graduates are taken from information reported by the

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[1]A complete list of major fields included in the designation science, engineering, or mathematics (using Classification of Instructional Program typology) is included in the appendix.

[2]Individuals who indicated that they were in graduate school at the time of the third followup survey (1986) were classified as college graduates.

respondents.[3] These data show that slightly fewer than one out of four college graduates (23.4 percent) had majored in science, engineering, or mathematics. (See table 1.)

DEMOGRAPHIC VARIABLES

Considerable differences emerge when the proportion of science, engineering, or mathematics graduates is classified by sex.[4] Almost one out of three (30.9 percent) of the male graduates had majored in science, engineering, or mathematics, while only about one out of six (16.4 percent) of the females majored in these fields. Moreover, more than half (52.1 percent) of all graduates were females.

Similarly, another demographic variable, socioeconomic status (SES)[5] in high school, was related to whether the student majored in science, engineering, or mathematics. Students from low- or low-middle-SES households majored in science, engineering, or mathematics somewhat more often than students from higher SES households. SES was also strongly related to whether the individual graduated from college. About half the college graduates were from the highest SES quartile in high school. Conversely, fewer than 1 out of 10 of the college graduates (8.6 percent) were in the lowest SES quartile in high school, but they majored in science, engineering, or mathematics in about the same proportion as high-SES graduates.

The proportion of science, engineering, or mathematics graduates among racial or ethnic groups did not differ significantly. Both Hispanics and blacks majored in these fields about as often as whites. Although considerable concern has been expressed that minorities are underrepresented among college

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[3]Individuals who had graduated from college but had not provided information on their major field of study (1.2 percent of all graduates) were classified as non-science graduates.

[4]Throughout this report, chi-square tests are used as measures of association between variables. The chi-square statistic, based on weighted data, is divided by the average weight adjusted for the High School and Beyond design effect to obtain the chi-square appropriate for the sample design used in High School and Beyond. Further information on the sample design and the design effects can be found in the appendix. Unless otherwise stated, all differences noted in the text are statistically significant at the .05 level.

[5]The SES index is a composite of five equally weighted measures: father's education, mother's education, family income, father's occupation, and presence of certain items (such as an encyclopedia) in the respondent's household.

graduates in technical fields, these data do not support that concern.

However, both Hispanics and blacks graduated from college in disproportionately small numbers. Although blacks represent 11.4 percent, and Hispanics 9.3 percent, of all high school seniors, the proportion of those who were college graduates was far smaller. The underrepresentation of these minorities lies not in their selection of major fields of study, but in their relatively low rates of attendance and graduation.

STUDENT CHARACTERISTICS

Several characteristics of the high school students appear strongly related to their college major. Large differences appear in two aspects of high school work: grades earned in high school and the number of hours students spent on homework. (See table 2.) Students who had the highest grades and who reported spending the most time on homework were the ones who most often majored in science, engineering, or mathematics.

Grades

More than one-third (35.4 percent) of the students who earned "straight A's" in high school graduated from college with majors in science, engineering, or mathematics. (See table 2 and figure 1.) By contrast, only one in five of the graduates who reported A's and B's (20.8 percent) or mostly B's (20.6 percent) majored in these fields.

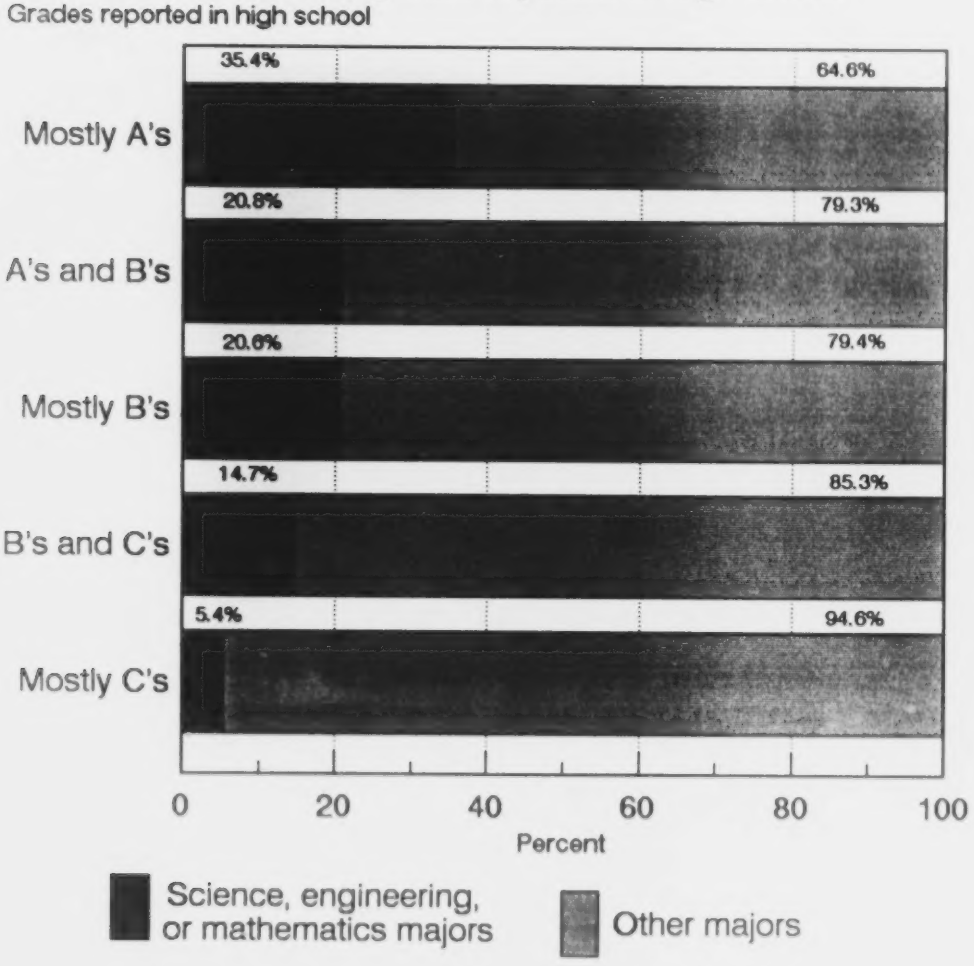
In general, those who graduated with majors in science, engineering, or mathematics reported higher grades in high school than those who majored in other fields.

Grades in high school	Science, engineering, or mathematics majors %	Other majors %
A's	47.4	27.9
A's and B's	27.4	33.7
B's	16.9	21.0
B's and C's	7.9	14.9
Lower	0.4	2.5

Study Habits

In addition, graduates who reported spending greater amounts of time in high school on homework were the ones who more often

Figure 1.--Major field of study in college of 1980 high school seniors who graduated from college by 1986, by grades reported in high school



NOTE: Details may not add to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

majored in science, engineering, or mathematics. Almost 3 out of 10 (29.0 percent) of the graduates who spent over 5 hours a week on homework while in high school majored in one of these fields. However, only a small proportion (7.9 percent) of college graduates had spent less than an hour a week on homework while in high school, and relatively few of them (15.0 percent) majored in science, engineering, or mathematics.

Type of School

In contrast to grades and time spent on homework, the type of school (public or private) the student attended was unrelated to choice of major field. About the same proportion of private and public school students majored in science, engineering, or mathematics in college.

The picture that emerges is that the harder working, and perhaps abler, students graduated from college with majors in science, engineering, or mathematics. Further analysis of these college graduates, based on the High School and Beyond aptitude tests given in their senior year of high school, supports this assertion. (See table 3.) The higher the test quartile, the greater the proportion of college graduates with majors in science, engineering, or mathematics.

Interest in High School

Students demonstrate interest in science by taking high school science courses and by intending to major in science in college. A review of the courses that college graduates took in high school reveals first that students who took certain advanced science and mathematics courses (especially calculus) more often graduated from college with majors in science, engineering, or mathematics. (See table 4.) Relatively few high school seniors took calculus (9.1 percent), and only about one-fourth (25.8 percent) of all college graduates reported that they studied calculus in high school. However, almost half of college graduates who took high school calculus (45.6 percent) majored in science, engineering, or mathematics, and to a lesser extent, this pattern was also true of those who took high school trigonometry or physics. By contrast, advanced English classes, taken by almost half of all college graduates (47.6 percent), were unrelated to majoring in science, engineering, or mathematics.

The relationship between taking high school courses and college major suggests that for many students, interest in science, engineering, or mathematics may already be well developed in high school. Further evidence of this notion can be obtained by asking seniors about their likely college major. (See table 5.) High school seniors who planned to go to college were asked to indicate the field that they would mostly likely

study. Over one-fourth (28.5 percent) of the 1980 seniors who later graduated from college said that they would study science, engineering, or mathematics.[6] Most of the high school seniors who later graduated from college were therefore interested in other fields (or did not respond).

Of those seniors who eventually graduated with a major in science, engineering, or mathematics, 56.6 percent had intended in high school to major in one of these fields. (See figure 2.) Thus, the 43.4 percent of the graduates who had not planned to major in these fields while in high school later changed their minds.[7]

Of those who eventually graduated with majors in other fields, fewer than one out of five (18.9 percent) had expressed an interest in majoring in science, engineering, or mathematics, but did not do so. Thus, there is considerable movement both into and out of the science, engineering, or mathematics fields. However, the movement out of these fields is somewhat larger (in terms of absolute numbers) than the movement into them.

FURTHER ANALYSES BY SEX AND RACE

This section will examine in more detail the relationships between sex, race, and graduating from college with a major in science, engineering, or mathematics.[8]

College Major by Sex

First, the proportion of female college graduates with majors in science, engineering, or mathematics was only about half the proportion of males. The proportion of females who reported straight A's in high school and later graduated from college (35.5 percent) was slightly higher than the proportion of male college graduates with the same high school grades (29.5 percent). However, substantial differences appear. (See table 6.) Nearly half of the male college graduates who had earned

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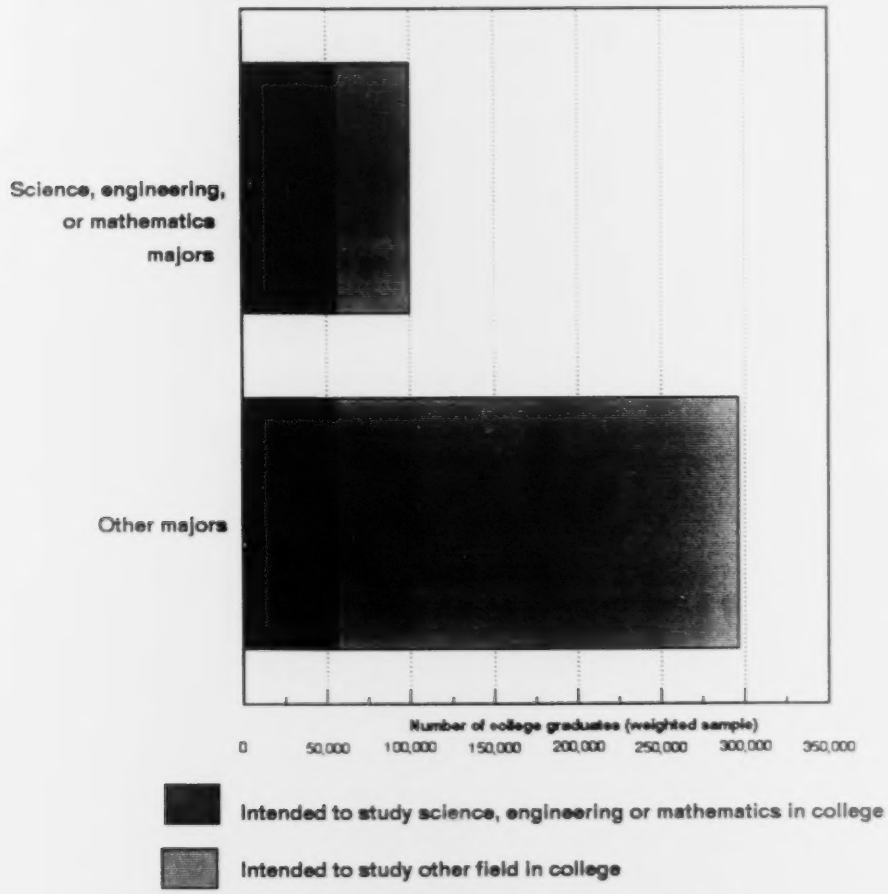
[6]Data are not available for about 22.6 percent of the respondents.

[7]Because of the relatively small sample size, it was not possible to analyze the intended major field of study of students who later went into science, engineering, or mathematics. Almost all possible majors were listed.

[8]Because most of the students who graduated from college with a major in science, engineering, or mathematics reported that they had mostly A's or A's and B's in high school and were from the highest two SES categories, it was not possible to analyze the data further by high school grades or SES.

Figure 2.--Major field of study in college of 1980 high school seniors who graduated from college by 1986, by intended college major



NOTE: The above figure is based on a sample of 1,444 high schol seniors.

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

straight A's in high school (47.5 percent) majored in science, engineering, or mathematics, but only about one-quarter of the females with straight A's (26.2 percent) did. In fact, males who reported A's and B's, or mostly B's, while in high school majored in science, engineering, or mathematics about as often as females who received mostly A's.

Therefore, differences in high school grades cannot account for the disparity between male and female majors in science, engineering, or mathematics. If grades were the deciding factor, females would major in science, engineering, and mathematics more often than males.

Also, although females who graduated from college generally had higher grades in high school than males, they did not necessarily take the same courses. Male college graduates, more often than their female counterparts, took certain advanced courses in high school: Physics was taken by over half (54.1 percent) of the males, but by substantially fewer females (32.7 percent), and calculus, which has been shown previously to be strongly related to majoring in science, engineering, or mathematics, was taken by 50 percent more males than females (31.2 percent of the males and 21.1 percent of the females). (See table 7.) The other course for which there were considerable differences was trigonometry, taken by 68.3 percent of the males and 58.8 percent of the females.

More than half (53.2 percent) of the males who took calculus and later graduated from college majored in science, engineering, or mathematics, but the proportion of females who followed the same path was smaller (36.1 percent). The same pattern was repeated with trigonometry and physics: More of the male graduates who took those courses majored in science, engineering, or mathematics than females. Although these factors alone do not account for the differences in college majors, the low rate at which females took these courses in high school probably contributes to the relatively small proportion of females majoring in science, engineering, or mathematics in college.

As might be anticipated from these data, the proportion of females in high school who intended to major in science, engineering, or mathematics in college was lower than the proportion of males. Fewer than one out of five females (18.2 percent) intended to major in one of these fields versus one out of three males (33.9 percent). (See table 8.)

Females who intended to major in science, engineering, or mathematics (already smaller in number than their male counterparts) were even less likely to graduate with a major in one of these fields. Some 54.2 percent of the males who intended to major in science, engineering, or mathematics graduated in one of these fields, but only 44.4 percent of the females did so. In

other words, a smaller proportion of females stayed in science, engineering, or mathematics from high school through college graduation, and fewer females came into science, engineering, or mathematics after high school (12.1 percent versus 20.9 percent for males).

College Major by Racial or Ethnic Group

There were virtually no differences between racial or ethnic groups in major field of study. An examination of college majors of these groups by sex, however, demonstrates that females of all races consistently majored in science, engineering, or mathematics less often than males. (See table 9.) White females majored in these fields about half as often as white males (15.7 percent versus 31.1 percent). Black females, however, majored in science, engineering, or mathematics almost as often as black males (26.3 percent of males versus 23.8 percent of females). The test for interaction between sex and race, however, was not quite statistically significant at the .05 level.[9]

As noted above, the proportion of minorities who graduated from college was substantially less than the percentage of minorities among high school seniors. The college graduation rate for black males is especially low. Only about 1 in 20 (5.1 percent) of these male high school seniors who graduated from college was black. The proportion of black females was higher; 7.8 percent of female college graduates were black.

DETAILED MAJOR FIELD OF STUDY

Throughout this report, science, engineering, and mathematics graduates have been grouped together. Because of the sample size,[10] each major field could not be analyzed separately. This section will separate the fields into engineering, mathematics and computer science, and natural and physical sciences.[11]

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[9]Using only data on blacks and whites in the analysis (dropping Hispanics) made the interaction between race and sex statistically significant.

[10]See the appendix for information on sample sizes.

[11]The natural and physical sciences consist of agricultural sciences, forestry and related sciences, health sciences, life sciences, and the physical sciences. The number of minorities in the sample was too small to permit further analysis of major field by race.

First, about one-third of the science majors (33.9 percent) majored in engineering; about one in five (19.9 percent) majored in mathematics and computer science; and the remainder, just under half (46.1 percent), majored in the natural and physical sciences. (See table 10.) Further, 44.8 percent of the male graduates majored in engineering, while 65.7 percent of the females majored in the natural and physical sciences.

Finally, intent in high school to major in science, engineering, or mathematics in college was also related to the specific major. Most (81.5 percent) of the engineering graduates intended to study science, engineering, or mathematics in college. By contrast, about half (51.7 percent) of the mathematics and computer science graduates and 4 out of 10 natural and physical science graduates intended to study science, engineering, or mathematics in college. Intention to study engineering, therefore, while still in high school is more closely related to graduating from college with an engineering degree than is interest in the other sciences or in mathematics.

CONCLUSIONS

This report has described college graduates in science, engineering, or mathematics who were part of a sample of high school seniors in 1980. From these data, graduates in these fields do not apparently differ much from other graduates in their demographic characteristics, with one important exception: More males than females graduate with such majors.

These college graduates differ from one another primarily in that those who in high school spent more time on homework, earned higher grades, and tended to score higher on the High School and Beyond achievement test more often majored in science, engineering, or mathematics. In other words, these were the hardest working, and perhaps the ablest, high school seniors (as measured by high school grades and scores on the High School and Beyond achievement test). They also took more advanced science and mathematics classes in high school and intended to study science, engineering, or mathematics in college more often.

These differences between graduates in science, engineering, or mathematics and other graduates do not account for the disparities between males and females, however. Regardless of grades in high school or courses taken, females consistently graduated less often than males with a major in one of these fields.

A few words of caution are in order. These data include only those students who had received a bachelor's degree within 6 years. Many of the 1980 high school seniors had not yet completed their undergraduate education and were therefore not included in the analysis.

In addition, the discussion grouped a variety of disciplines together, but excluded the behavioral and social sciences. Substantial differences might have been discovered if different major fields had been examined individually, or if science had been defined more narrowly or more broadly.

Table 1.--1980 high school seniors who graduated from college by 1986, by major field of study and by sex, race or ethnicity and socioeconomic status in high school

(In percents)

Student characteristic	College graduates, by major field of study			Percentage of all college graduates	Percentage of all 1980 high school seniors
	Total (Sample size)	Science, engineering, or mathematics majors	Other majors		
Total	100.0 (1,712)	23.4	76.7	100.0	100.0
Sex					
Male	100.0 (784)	30.9	69.1	47.9	48.8
Female	100.0 (928)	16.4	83.6	52.1	51.2
Race or ethnicity 1/					
White	100.0 (1,066)	23.3	76.8	89.8	79.3
Black	100.0 (275)	24.7	75.3	6.5	11.4
Hispanic	100.0 (257)	23.3	76.7	3.7	9.3
Socioeconomic status (SES) in high school 2/					
High	100.0 (672)	24.4	75.6	51.0	24.9
High-middle	100.0 (399)	19.1	80.9	26.1	25.1
Low-middle	100.0 (269)	32.5	67.5	14.4	25.1
Low	100.0 (308)	28.0	72.0	8.6	25.0

1. Insufficient data for races other than those listed.

2. The SES index is a composite of five equally weighted measures: father's education, mother's education, family income, father's occupation, and presence of certain items (such as an encyclopedia) in the respondent's household.

NOTE: Details may not add to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

Table 2.--1980 high school seniors who graduated from college by 1986, by major field of study and student characteristics in high school

(In percents)

Student characteristics in high school	College graduates, by major field of study			Percentage of all college graduates	Percentage of all 1980 high school seniors
	Total (Sample size)	Science, engineering, or mathematics majors	Other majors		
Total	100.0 (1,712)	23.4	76.7	100.0	100.0
Grades in high school					
Mostly A's	100.0 (521)	35.4	64.6	32.6	12.5
A's and B's	100.0 (537)	20.8	79.3	32.2	21.3
Mostly B's	100.0 (335)	20.6	79.4	20.0	21.1
B's and C's	100.0 (212)	14.7	85.3	13.2	26.4
Mostly C's	100.0 (43)	5.4	94.6	1.7	12.7
C's and D's or lower	--	--	--	--	6.1
Type of high school attended					
Public	100.0 (1,349)	23.7	76.3	81.8	89.9
Private	100.0 (363)	21.6	78.4	18.2	10.2
Hours spent on homework in high school per week					
Less than 1	100.0 (131)	15.0	85.0	7.9	24.3
1 to 5	100.0 (720)	20.5	79.5	44.4	50.9
More than 5	100.0 (804)	29.0	71.1	47.7	24.8

-- Insufficient data.

NOTE: Details may not add to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

Table 3.--High school test quartile of 1980 high school seniors who graduated from college by 1986, by major field of study
(In percents)

Test quartile	College graduates, by major field of study			Percentage of all college graduates	Percentage of all 1980 high school seniors
	Total (Sample size)	Science, engineering, or mathematics majors	Other majors		
Total	100.0 (1,535)	23.4	76.7	100.0	100.0
Highest quartile	100.0 (801)	30.1	69.9	56.6	25.2
Second highest quartile	100.0 (398)	23.2	76.8	25.6	25.1
Third highest quartile	100.0 (243)	15.2	84.8	14.4	24.9
Lowest quartile	100.0 (93)	15.7	84.3	3.5	24.9

NOTE: Details may not add to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

Table 4.--Advanced courses taken in high school by 1980 seniors who graduated from college by 1986, by major field of study in college
(In percents)

Advanced courses taken in high school	College graduates, by major field of study			Percentage of all college graduates	Percentage of all 1980 high school seniors
	Total (Sample size)	Science, engineering, or mathematics majors	Other majors		
Total	100.0 (1,712)	23.4	76.7	--	--
Algebra I	100.0 (1,652)	24.3	75.7	98.0	80.3
Algebra II	100.0 (1,631)	26.4	73.6	83.9	51.1
Geometry	100.0 (1,634)	24.7	75.3	92.8	58.3
Trigonometry	100.0 (1,572)	32.8	67.2	63.3	28.4
Calculus	100.0 (1,468)	45.6	54.4	25.8	9.1
Physics	100.0 (1,517)	40.9	59.1	42.9	21.7
Chemistry	100.0 (1,594)	28.7	71.3	75.0	39.5
Advanced English	100.0 (1,641)	24.3	75.7	47.6	30.0

-- Not applicable.

NOTE: Courses taken are through grade 12, as reported by the students. Details may not add to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

Table 5.--Intended college field of study of 1980 high school seniors who graduated from college by 1986, by actual field of study
(In percents)

Intended field of study in college in 1980	College graduates, by major field of study			All 1980 high school seniors planning to attend college
	Science, engineering or mathematics graduates	Other majors	All college graduates	
Total (sample size)	100.0 (365)	100.0 (1,079)	100.0 (1,444)	100.0 (6,484)
Science, engineering, or mathematics	56.6	18.9	28.5	24.5
All other fields	43.4	81.1	71.5	75.5

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

Table 6.--1980 high school seniors who graduated from college by 1986, by major field of study, by grades reported in high school, and by sex
(In percents)

Grades reported in high school	College graduates, by major field of study			Percentage of all college graduates	Percentage of all 1980 high school seniors
	Total (Sample size)	Science, engineering, or mathematics majors	Other majors		
Males					
Mostly A's	100.0 (214)	47.5	52.5	29.5	9.6
A's and B's	100.0 (237)	28.0	72.0	31.0	17.2
Mostly B's	100.0 (150)	28.8	71.2	19.7	20.4
B's and C's	100.0 (124)	20.9	79.1	17.0	28.4
C's or lower	--	--	--	2.8	24.5
Females					
Mostly A's	100.0 (307)	26.2	73.8	35.5	15.2
A's and B's	100.0 (300)	14.6	85.4	33.2	25.0
Mostly B's	100.0 (185)	13.3	86.7	20.2	21.7
B's and C's	100.0 (88)	--	--	9.7	24.6
C's or lower	--	--	--	1.4	13.6

NOTE: Details may not add to totals because of rounding.

-- Insufficient data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

Table 7.--Advanced courses taken in high school by 1980 high school seniors who graduated from college by 1986, by major field of study in college and by sex
(In percents)

Sex and advanced courses taken in high school	College graduates, by major field of study			Percentage of all college graduates	Percentage of all 1980 high school seniors
	Total (Sample size)	Science, engineering, or mathematics graduates	Other graduates		
Males					
Algebra I	100.0 (756)	32.6	67.4	97.2	79.8
Algebra II	100.0 (747)	34.4	65.6	84.2	53.4
Geometry	100.0 (746)	32.5	67.5	92.9	60.1
Trigonometry	100.0 (717)	40.0	60.0	68.3	32.9
Calculus	100.0 (666)	53.2	46.8	31.2	11.0
Physics	100.0 (695)	48.7	51.3	54.1	28.1
Chemistry	100.0 (730)	37.0	63.0	77.7	41.7
Advanced English	100.0 (747)	33.8	66.2	41.5	26.3
Females					
Algebra I	100.0 (896)	17.3	82.7	98.7	80.8
Algebra II	100.0 (884)	19.7	80.3	83.6	48.9
Geometry	100.0 (888)	18.1	81.9	92.6	56.6
Trigonometry	100.0 (855)	26.0	74.0	58.8	24.2
Calculus	100.0 (802)	36.1	63.9	21.1	7.4
Physics	100.0 (822)	29.7	70.3	32.7	15.7
Chemistry	100.0 (864)	21.3	78.7	72.6	37.6
Advanced English	100.0 (894)	17.8	82.2	53.1	31.2

NOTE: Courses taken are through grade 12, as reported by the students.

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

Table 8.--College major field of study of 1980 high school seniors who had graduated from college by 1986, by intended field of study in high school, and by sex
(In percents)

Sex and intended field of study in college in 1980	College graduates, by major field of study			All college graduates	All 1980 high school seniors planning to attend college
	Total (sample size)	Science, engineering, or mathematics graduates	Other graduates		
Males					
Total	100.0 (668)	33.9	66.1	100.0	100.0
Science, engineering, or mathematics	100.0 (230)	54.2	45.8	39.1	31.2
All other fields	100.0 (438)	20.9	79.1	60.9	68.8
Females					
Total	100.0 (786)	18.2	81.8	100.0	100.0
Science, engineering, or mathematics	100.0 (152)	44.4	55.6	18.8	19.6
All other fields	100.0 (634)	12.1	87.9	81.2	80.4

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

Table 9.--1980 high school seniors who graduated from college by 1986, by major field of study and by race/ethnicity, and by sex

(In percents)

Sex and race/ethnicity	College graduates, by major field of study			Percentage of all college graduates	Percentage of all 1980 high school seniors
	Total (Sample size)	Science, engineering, or mathematics majors	Other majors		
Males					
Total	100.0 (730)	30.8	69.2	100.0	100.0
White	100.0 (491)	31.1	68.9	91.2	79.9
Black	100.0 (114)	26.3	73.7	5.1	10.6
Hispanic	100.0 (125)	29.0	71.1	3.8	9.5
Females					
Total	100.0 (868)	16.5	83.6	100.0	100.0
White	100.0 (575)	15.7	84.3	88.5	78.8
Black	100.0 (161)	23.8	76.2	7.8	12.2
Hispanic	100.0 (132)	18.1	81.9	3.7	9.0

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

Table 10.--Detailed major field of study in college of 1980 high school seniors who graduated from college by 1986, by sex and by intended college major

(In percents)

Student characteristics	Total (Sample size)	Engineering	Mathematics and computer science	Natural and physical sciences*
Total	100.0 (429)	33.9	19.9	46.1
Sex				
Males	100.0 (259)	44.8	20.4	34.8
Females	100.0 (170)	15.1	19.2	65.7
Intended college major in high school				
Total	100.0 (382)	100.0	100.0	100.0
Science, engineering or mathematics	100.0 (166)	81.5	51.7	41.0
Other fields	100.0 (216)	18.5	48.3	59.0

*Includes agricultural sciences, forestry and related sciences, health sciences, life sciences, military sciences and physical sciences.

NOTE: Details may not add to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

Appendices

Fields of Study Classified as Science, Engineering, or Mathematics

Technical Notes

Appendix Tables

Fields of Study Classified as
Science, Engineering, or Mathematics

Classification of Instructional Program Code	Field of study
20201 through 29999	Agricultural Sciences
30501 through 30599	Forestry and Related Sciences
110101 through 119999	Computer and Information Sciences
140101 through 159999	Engineering
180101 through 189999	Health Sciences
260101 through 269999	Life Sciences
270101 through 279999	Mathematics
280101 through 289999	Military Sciences
400101 through 409999	Physical Sciences

NOTE: There are no commonly accepted definitions of fields included in "science" and "engineering." The above classification comprises a relatively broad definition of these fields but excludes the social and behavioral sciences. The fields of agricultural sciences, forestry and related sciences, and military sciences included less than 1 percent of the college graduates in the sample.

Technical Notes

The estimates presented in this report were based on the High School and Beyond survey of high school seniors. Complete information on this data set is provided in High School and Beyond Senior Cohort Third Follow-Up (1986).[12] High School and Beyond, a longitudinal study that began in 1980, collected questionnaire data from a representative sample of high school seniors and sophomores. Students were recontacted in 1982, 1984, and 1986.

Data on race or ethnicity, sex, and socioeconomic status were classified using composite variables included on the High School and Beyond data tapes. Data on student characteristics in high school (such as hours spent on homework per week, grades in high school, intended field of study in college, and high school courses taken) are from information provided by the students. Data on High School and Beyond test scores are from the combined score of reading, vocabulary, and mathematics tests administered to most of the students in the sample in 1980. Further information is contained in appendix C of the High School and Beyond User's Manual.

As with all sample surveys, these data are subject to both sampling error and nonsampling error. The former occurs because this survey queried a sample of students, rather than the entire population. Estimates based on these data will differ somewhat from the figures that would have been obtained if a complete census with the same survey instrument, instructions, and procedures had been used.

The total number of 1980 high school seniors interviewed in 1986 is 10,536. The number who had graduated from college by the time of the 1986 survey is 1,712, of which 429 were classified as science, engineering, or mathematics majors. For certain questions, the number of nonresponding students was relatively high. For instance, data on their intended college major are available for only 1,444 college graduates. The reader should be cautioned against making generalizations based on questions for which a substantial proportion of the sample did not provide information. In addition, the relatively small number of science graduates precluded certain analyses that might have proved useful, such as examining individual fields of study by sex.

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[12]U.S. Department of Education, National Center for Education Statistics, High School and Beyond 1980 Senior Cohort Third Follow-Up (1986), Volume II: Data File User's Manual (Washington, D.C. 1986). This volume contains detailed information on the sample selection and design, data collection instruments, and data files.

The High School and Beyond sample, while representative and statistically accurate, is not a simple random sample. Students were selected within schools grouped by strata. Because sampling rates for schools within different strata differ, better data for policy purposes result, but at a cost of statistical efficiency. As a result, simple random sample techniques for estimating standard errors frequently underestimate the true standard errors.

Unless otherwise noted, all relationships stated in this report are significant at the .05 level of confidence. The test used was the chi-square, adjusted for the High School and Beyond sample design. Chi-square tests were calculated on weighted data, adjusted by the mean weight. The chi-square value was then divided by the average design effect for the High School and Beyond survey (2.28).

Tables A1 through A3 present sample sizes used in the other tables in this report.

Table A1.--Unweighted numbers of 1980 high school seniors who graduated from college by 1986, by sex, race/ethnicity and student characteristics

Student characteristic	Science, engineering, or mathematics majors	Other majors	Total	All 1980 high school seniors interviewed in 1986
Total	429	1,283	1,712	10,536
Sex				
Male	259	525	784	4,832
Female	170	758	928	5,704
Race or ethnicity				
White	248	818	1,066	4,939
Black	72	203	275	2,514
Hispanic	69	188	257	2,512
Grades in high school				
Mostly A's	181	340	521	1,191
A's and B's	128	409	537	2,108
Mostly B's	67	268	335	2,032
B's and C's	32	180	212	2,794
Mostly C's	5	38	43	1,941
C's and D's or lower	0	5	5	602
Type of high school attended				
Public	342	1,007	1,349	9,385
Private	87	276	363	1,151
Hours spent on homework in high school per week				
Less than 1	23	108	131	2,262
1 to 5	149	571	720	5,172
More than 5	241	563	804	2,659
Intended field of study in college for those planning to attend				
Science, engineering, or mathematics	212	202	414	1,598
Other	163	877	1,040	4,886
Socioeconomic status (SES) in high school				
High	169	503	672	3,693
High-middle	88	311	399	2,253
Low-middle	75	194	269	2,024
Low	81	227	308	1,882
High school test quartile				
Highest quartile	247	554	801	2,138
Second highest quartile	94	304	398	1,954
Third highest quartile	42	201	243	2,094
Lowest quartile	14	79	93	2,927
Students who took selected courses in high school				
Algebra I	409	1,200	1,609	7,907
Algegra II	379	971	1,350	4,977
Geometry	389	1,102	1,491	5,468
Trigonometry	340	655	995	2,589
Calculus	171	184	355	812
Physics	272	384	656	2,082
Chemistry	358	815	1,173	3,788
Advanced English	211	659	870	7,032

NOTE: Courses taken are through grade 12, as reported by the students. Details may not add to total number of students in survey for some items because of missing data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

Table A2.--Unweighted numbers of 1980 high school seniors who graduated from college by 1986, by detailed major field of study in college, by sex, and by intended college major

Student characteristics	Engineering	Mathematics and computer science	Natural and physical sciences*	Total
Total	136	126	167	429
Sex				
Male	110	96	53	259
Female	26	30	'114	170
Intended college major in high school				
Science, engineering or mathematics	94	45	77	216
Other fields	23	31	112	166

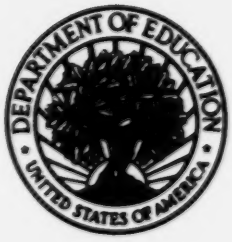
*Includes agricultural sciences, forestry and related sciences, health sciences, life sciences, military sciences and physical sciences.

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.

Table A3.--Unweighted numbers of 1980 high school seniors who graduated from college by 1986, by sex, by advanced courses taken in high school, and by major field of study

Courses taken in high school	Science, engineering, or mathematics majors	Other majors	Total	All 1980 high school seniors
Males				
Algebra I	246	485	731	3,581
Algegra II	226	411	637	2,367
Geometry	232	454	686	2,557
Trigonometry	203	294	497	1,373
Calculus	108	85	193	453
Physics	180	195	375	1,205
Chemistry	214	359	573	1,829
Advanced English	139	287	426	3,307
Females				
Algebra I	163	715	878	4,326
Algegra II	153	560	713	2,610
Geometry	157	648	805	2,911
Trigonometry	137	361	498	1,216
Calculus	63	99	162	359
Physics	92	189	281	877
Chemistry	144	456	600	1,959
Advanced English	72	372	444	3,725

SOURCE: U.S. Department of Education, National Center for Education Statistics, "High School and Beyond" survey, 1986.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